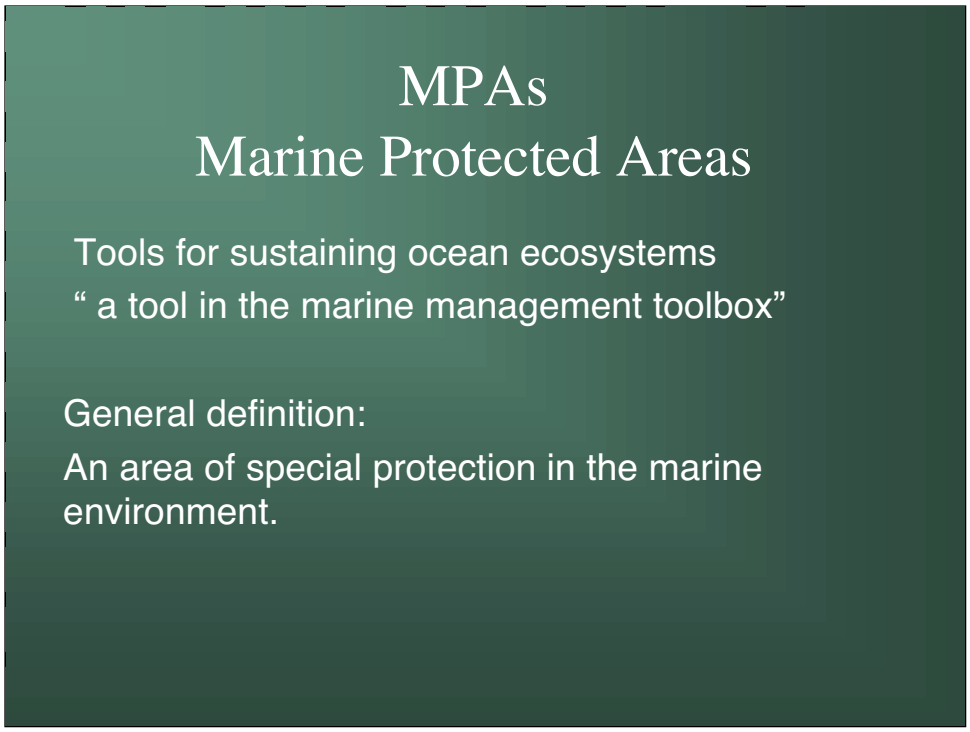
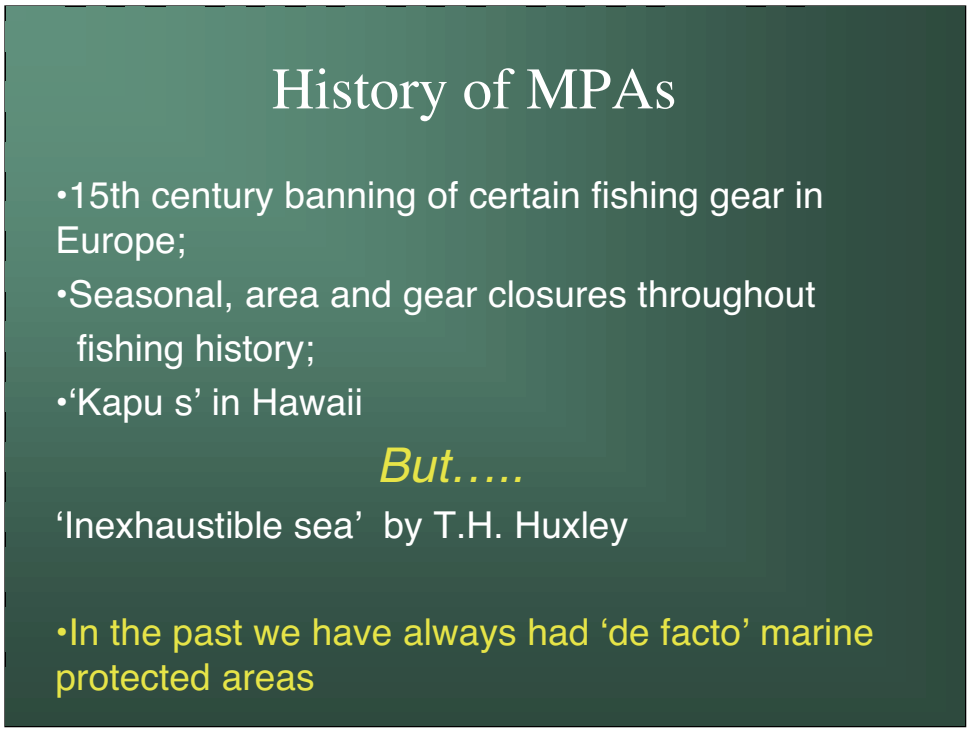


Marine Protected Areas are a tool among many within the tool-box for marine resource management. A general definition, or umbrella term for Marine Protected Areas or MPAs is "an area of special protection in the marine environment." The level of protection depends on the goals of the MPA or the managing agency.

Most MPAs may have been implemented to accomplish the following: protect endangered species or critical habitat; for fishery management purposes; to increase or conserve biodiversity; or to protect submerged cultural resources such as shipwrecks. There are many types of MPAs in various shapes and sizes, ranging from less than an acre to thousands of square miles. MPAs are also found in various ecosystems for the protection or enhancement of many types of marine resources.

Executive Order 13158 on MPAs, issued in May of 2000, defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal or local laws or regulations to provide lasting protection for part of all of the natural and cultural resources therein. The term MPA should not be confused with the term 'no take' marine reserve, aka marine reserve, which is one type of an MPA in which marine resources are protected from extractive activities. During this presentation I will be very careful to distinguish between a 'no-take' marine reserve and an MPA.

Why are MPAs receiving so much media attention now? 50% of the U.S population lives within 50 miles of the coast and is projected to be between 60% and 70% by the year 2020. The explosion in population growth has put a tremendous amount of stress on our coastal environment. For example, coastal development has filled in valuable wetlands and compromised the important role wetlands play as nursery grounds for many young and vulnerable marine species. Coastal deforestation has contributed to increased loads of silt and sediments that are carried to coastal waters as run-off and are very damaging to sensitive corals or mangrove communities. Furthermore, run-off containing large quantities of land-based fertilizers have triggered harmful algal blooms in our coastal waters that are increasing in their intensity and occurrence. These harmful algal blooms in combination with pollution and disease have been the source of numerous beach closures and loss of valuable tourist dollars. Fisheries collapses on both coasts have brought economic, social and ecological devastation to fishing communities that depend on healthy fisheries. MPAs have been put forth as a tool to address these problems within our coastal and oceanic waters.



The History of MPAs reveals that we have been using MPAs for a long time. Already dating back to the 15th century, MPAs were used in Europe to protect bottom habitat by banning certain fishing gear in those areas. Throughout fishing history, MPAs have been extensively used to establish seasonal, area, or gear closures.

An interesting and probably highly effective use of MPAs, due to the method of enforcement, can be found in the history of Hawaii. Captain James Cook on his voyages through Hawaii came across the Kapu system, which was an extensive system of MPAs under authority of the chief of the tribe. Violation of Kapu or fishing within a kapu was punishable by death.

Our long history of using MPAs, primarily for managing a harvestable resource, ended in the late 19th century when the paradigm shifted to the 'inexhaustible sea,' a theory postulated by T.H. Huxley. His theory proposed that the ocean was inexhaustible, and infinite in its ability to supply food and absorb any practice or abuse. The perception that the ocean is inexhaustible persists until today. In the past we also always had 'de-facto' MPAs, those areas protected from human influences and practices, because they were too remote or dangerous to reach. Advances in technology have made most 'de facto' MPAs obsolete.

MPAs are **Management tools** that **protect, maintain, or restore natural and cultural resources** in coastal and marine waters nationally and internationally.

Specifically, MPAs:

- Conserve biodiversity
- Manage natural resources
- Protect endangered species
- Reduce user conflicts
- Provide educational and research opportunities
- Enhance commercial and recreational activities

MPAs are a management tool that may protect, maintain, or restore natural and cultural resources in coastal and marine waters nationally and internationally.

Specifically, MPAs are a management tool that may do the following:

•restore and conserve biodiversity;

•manage natural resources;

•protect endangered species or sensitive habitats;

•reduce user conflict through creative zoning of the marine environment;

•provide educational and research opportunities.

In essence, we have been conducting uncontrolled experiments in the coastal environment. MPAs can serve as a reference area to assist us with differentiating between natural perturbations, such as El Nino, and human induced perturbations such as those caused by pollution or overfishing. MPAs are also a management tool to enhance commercial and recreational activities such as tourism. Most of us have fond memories of spending a wonderful day at the beach, swimming or body surfing.

Types of MPAs :
Department of Interior

- National Parks & Seashores
- National Monuments
- National Wildlife Refuges

MPAs can be categorized multiple ways based on many types of criteria, such as purpose of MPA, type of marine resource protected, or legal authority by which the MPA has been established. I have chosen the latter option to provide a very preliminary overview of marine managed areas that are part of the National Inventory on Marine Managed Areas, that can be found on the MPA.GOV web site.

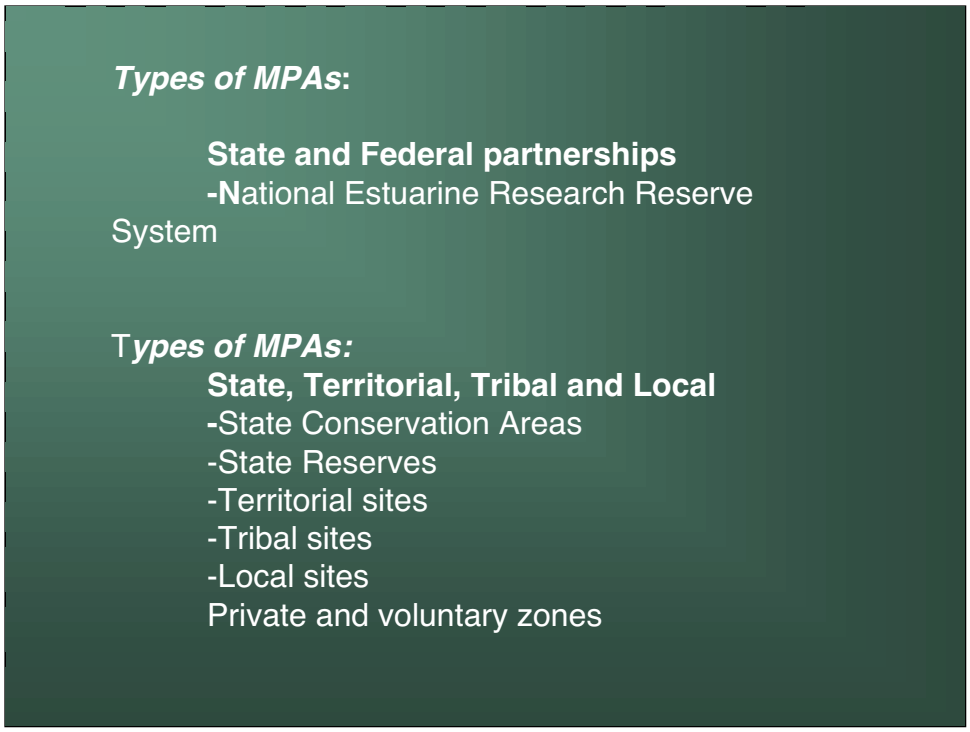
The Federal Government generally has jurisdiction over marine resources and its environs from 3 nm to 200 nm, but may share jurisdiction with States, territories, and tribes from the shoreline out to 3 nm. The Dept of Interior and Commerce have designated various types of MPAs through several statutory authorities. The Dept of Interior has designated the following:

- 39 National Parks and Seashores within the marine environment under the National Park System Organic Act of 1962.
- National Monuments are designated either by Presidential proclamation under the Antiquities Act of 1906 or by Congress. Probably the most well known Marine National Monument, undergoing a transition to a National Marine Sanctuary, is the North Western Hawaiian Islands Reserve designated in 2000. The NWHI Reserve provides valuable protection to vulnerable coral reefs and is approx 100.000 square miles in size and one of the largest MPAs in the world.
- The National Wildlife Refuge system has contributed 162 sites to the National Inventory. Refuges are designated by the System Administration Act of 1962.

Types of MPAs :
Department of Commerce/NOAA
- Fishery Management Zones
- National Marine Sanctuaries
- National Estuarine Research Reserves
- Critical Habitats

The Department of Commerce houses the National Oceanic and Atmospheric Administration or NOAA. NOAA's mission is to conserve and wisely manage the Nation's coastal and marine resources. Several types of MPAs are managed by NOAA.

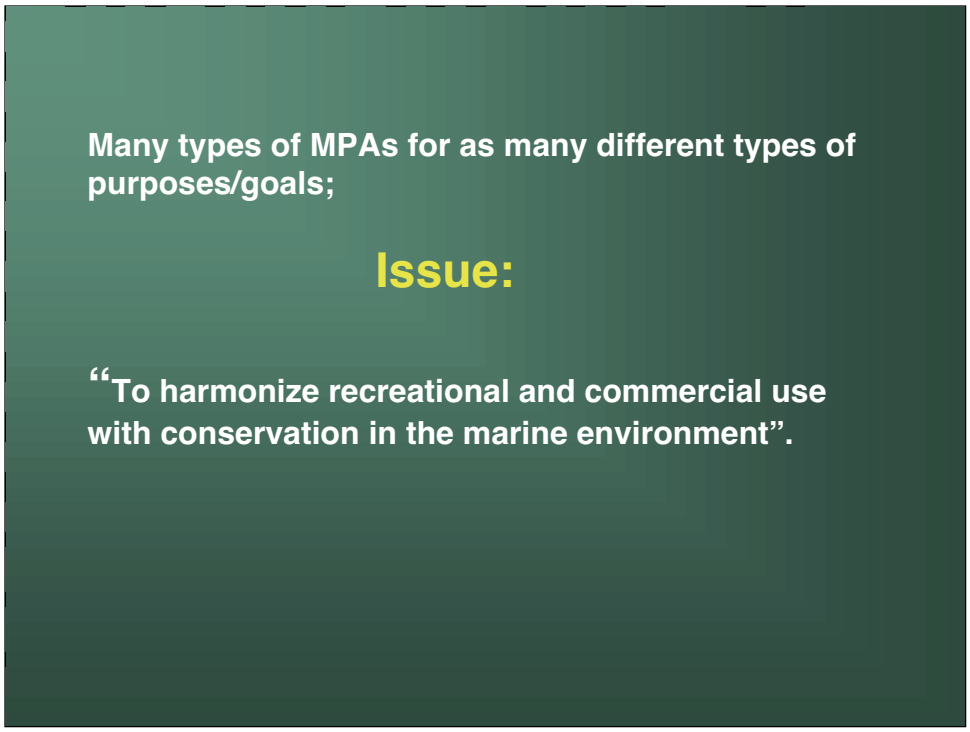
- Fishery Management Councils representing the 8 fishery regions of our country work with NOAA's Fisheries Service to establish Fishery Management Zones for the purposes of rebuilding or sustainably utilizing our fisheries. NOAA Fisheries Services also designates critical habitats for endangered species or marine mammals under authority of the Endangered Species Act or the Marine Mammal Protection Act.
- The National Marine Sanctuaries Act provides the authority to establish a National Marine Sanctuary, of which there are currently 13 situated around our country, including the Great Lakes.
- The National Estuarine Research Reserves System is a state and Federal (managed by NOAA) partnership composed of 25 reserves located within most coastal and Great Lakes' states.



MPAs other than Federally authorized sites can also be found within state, territorial, tribal and local waters. Actually the bulk of MPAs, in number, are found within state waters consisting of the area between the shoreline and 3 nm out. Many state MPAs share management of the MPA with Federal or other governmental or private entities.

- Another example of a Federal-State partnership in support of MPAs are the Oyster Sanctuaries of the Chesapeake bay.
- The state of California, under state authority of the Marine Life Protection Act and Marine Life Management Act, is currently going through a review process to better manage their 100 plus MPAs by using networks. Similar initiatives are being implemented or considered in other states.
- The Territories Guam and Puerto Rico have numerous MPAs in their waters that protect coral reef ecosystems. MPAs may also be established and managed under jurisdiction of people from the First Nations.
- A few marine zones are co-managed by state or local government and volunteer groups.
- Edmonds Underwater Park in the Puget Sound of Washington is an example of an MPA managed by a group of divers. The park is only 27 acres in size but provides scuba divers with an opportunity to observe unique and pristine underwater communities of animals and plants that are undisturbed by fishing or other extractive activities.

This slide provides a map of the US depicting the locations of the National Marine Sanctuaries and National Estuarine Research Reserves. You can see that the West Coast contains the largest Marine Sanctuaries but far fewer National Estuarine Research Reserves compared to the East Coast



MPAs have been designed and implemented for many different goals and purposes and under various statutory authorities. A common goal for MPAs has been to reduce user conflict over precious and dwindling marine resources. MPAs have been promoted and implemented successfully as a zoning tool to harmonize recreational and commercial use with conservation in the marine environment.

The Florida Keys National Marine Sanctuary is a powerful example of how, through marine zoning, disparate uses and goals can coexist next to each other. In 1997, the Florida Keys Sanctuary established a pioneering marine zoning program that included three types of no-take zones: eighteen small sanctuary preservation areas, four special use areas and an ecological reserve. The zones comprised less than one percent of the sanctuary but protected much of its critical coral reef habitat. The establishment of the zones was a significant step towards protecting Sanctuary resources for the long-term and restoring a natural assemblage of organisms. There are many surprises ahead in terms of what we learn about interactions between organisms and how the coral reef ecosystem functions. Already, Sanctuary biologists are surprised to see how quickly spiny lobsters have responded, in numbers and size to the protection afforded by the zones.

The optimal design and implementation of MPAs poses many challenges and opportunities

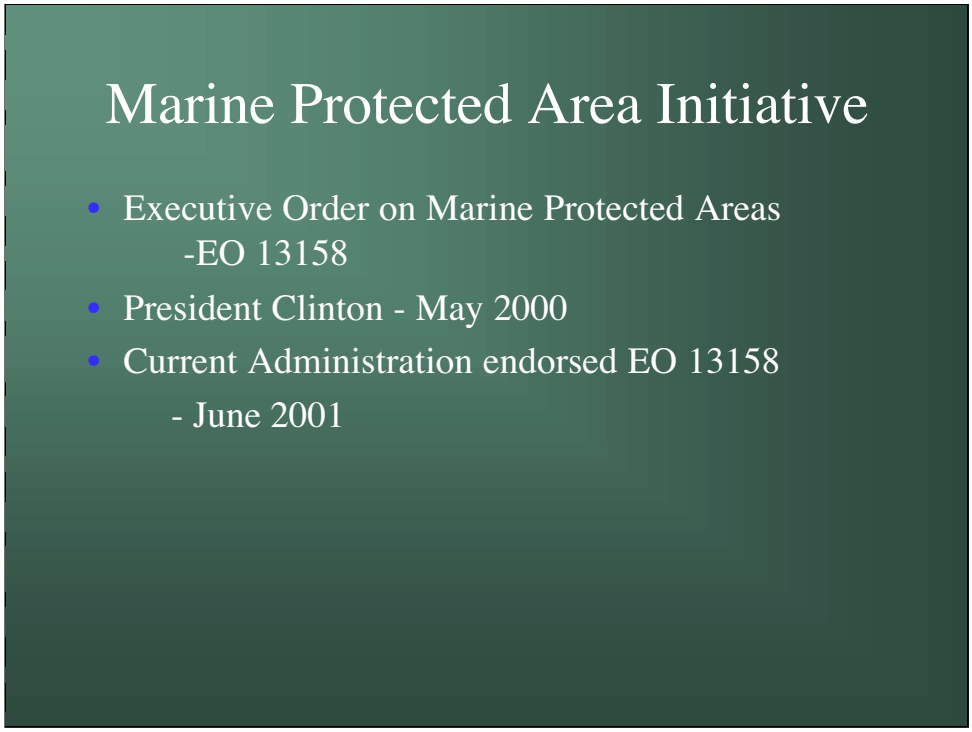
•How can we use MPAs effectively as a management tool?

•What is the appropriate spatial scale for implementation? Few large MPAs or many small MPAs?

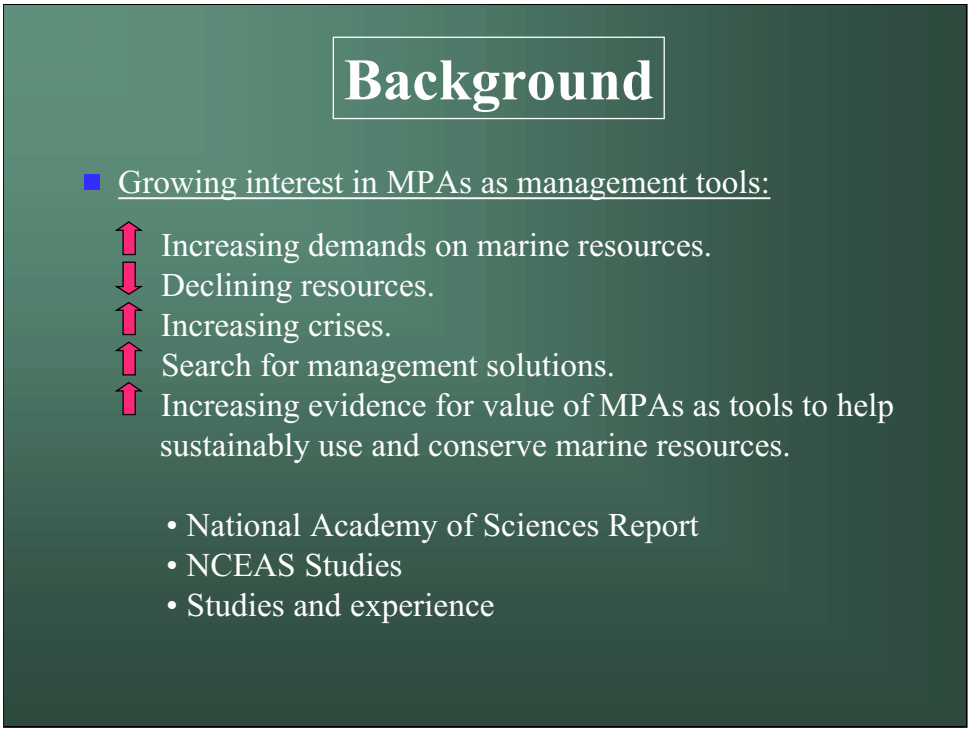
•What is the appropriate temporal scale or period for measuring the performance of an MPA in terms of yielding ecological benefits or improving ecosystem functions?

•What are the goals of an individual MPA or network of MPAs?

Another challenge is to improve coordination of management, resources, enforcement and research across jurisdictions of the governmental landscape. Partnerships provide the opportunity to improve scientific effort, tools and communications across MPAs. But those partnerships need first to be formed, which is a challenge but also an opportunity to include all interests in the design and implementation of MPAs. It is challenging to include the diverse interests ranging from fishing and mining to conservation, but also an opportunity to bring all stakeholder groups to the table with their expertise to evaluate and design an MPA that will also be socially sustainable by the user groups.



In part to address these challenges and opportunities, the former Clinton Administration issued in May 2000 Executive Order 13158 on Marine Protected Areas. The current Bush Administration endorsed EO 13158 in June 2001. The Executive Order tasks those agencies whose authority provides for the establishment or management of MPAs to enhance or expand protection of existing MPAs and to establish or recommend as appropriate, new MPAs, through improved communications, coordination and information sharing. The Executive Order provides guidelines for the protection of significant natural and cultural resources within the marine environment for the benefit of present and future generations.



The following scientific information served as background for the Executive Order:

•As human populations have increased, the demand on marine resources has increased.

•Marine resources have been in decline due to excessive use and damaging practices.

•Increases in anthropogenic stresses on our coastal resources have led to an increase in coastal and oceanic crises, such as harmful algal blooms and fishery collapses.

•Coastal managers and decision-makers are in search of management solutions to address these problems.

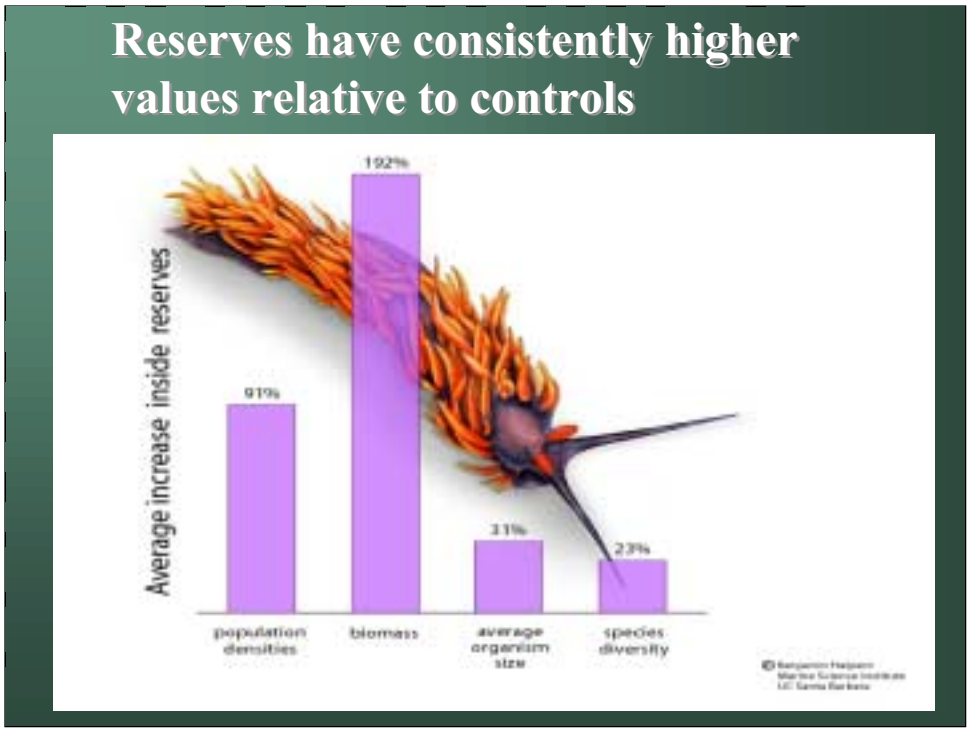
•There is increasing evidence from scientific sources that MPAs have value as a tool to help sustainably use and conserve marine resources.

The most well known scientific sources in support of MPAs are as follows:

•The National Academy of Sciences report presented by Dr. Susan Roberts in this educational series.

•The National Sciences Foundation study conducted by the National Center for Ecological Analysis and Synthesis – aka NCEAS, and

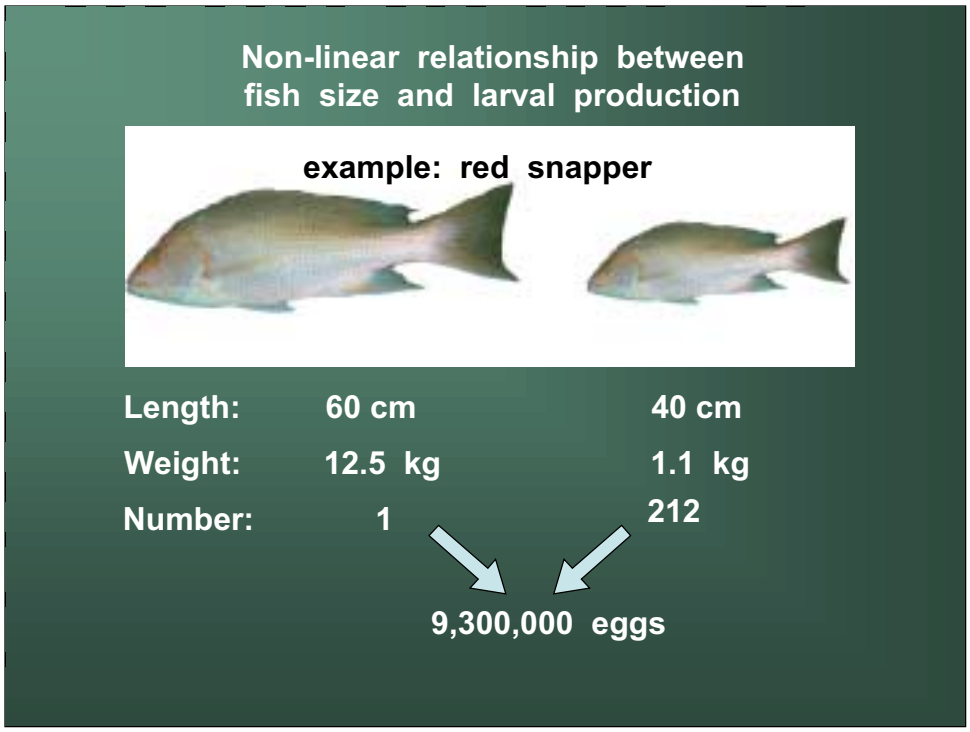
•The individually published studies and experiences that are becoming more numerous as time goes by.



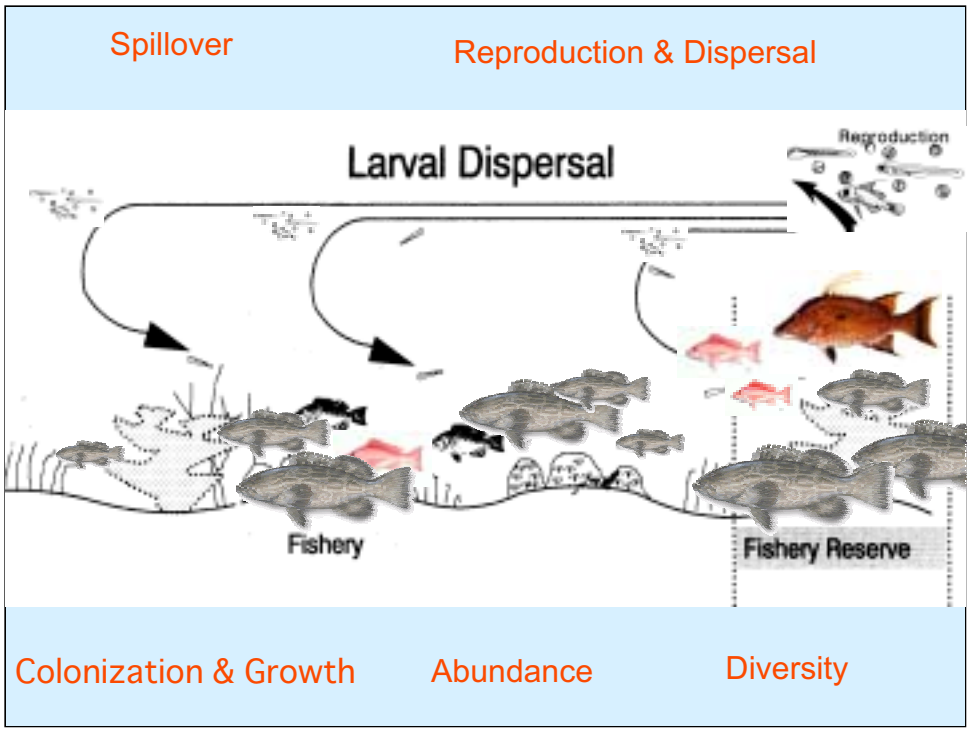
This slide briefly and graphically depicts one of the comparative NCEAS studies that measured the effect of marine reserves, a type of MPA where fishing and other extractive activities are prohibited. Ben Halpern from the University of California at Santa Barbara synthesized information across102 studies from 80+ different marine reserves . The effect of a marine reserve was measured by comparing several biological parameters within the marine reserve to those outside the reserve, also referred to as the control site. These are the results of the assessment:

- Population densities or number of organisms within the marine reserve increased on average by 91%.
- The average size of an organism increased on average by 31% inside the reserve compared to the control reference sites outside the marine reserve.
- The average biomass of organisms, which is a function of number of organisms and their size, on average nearly increased by 200% inside the marine reserve compared to outside the marine reserve.
- Species diversity increased on average by 23%.

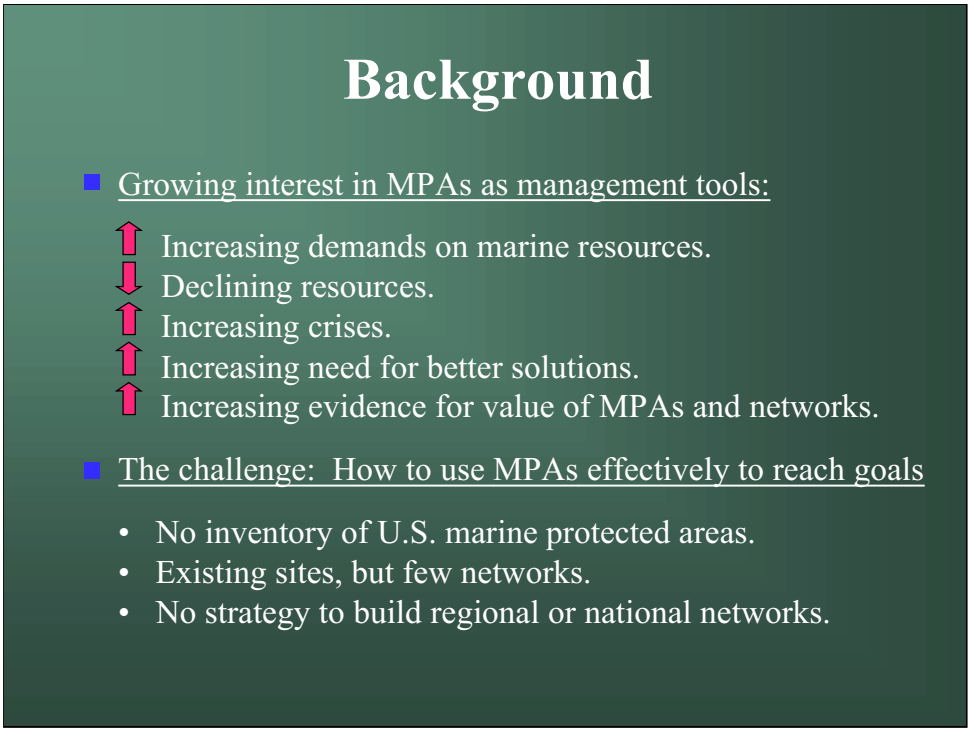
It might not be surprising that within areas where fishing is prohibited the number of individuals and their size would increase, with the number of different types of organisms increasing too. The effects were all positive though and accumulated over a brief period of time no matter the size of the marine reserve or the types of organisms measured – from fishes to invertebrates.



This slide depicts why a larger marine organism has more value compared to a smaller organism. One 60-cm snapper weighs 12.5 kg and produces the same amount of eggs – approx. 9 million – as 212 40-cm fish that weigh approximately 1.1 kg each. Once these eggs are fertilized they form the source of future snappers. Thus, a fish's reproductive value doesn't merely increase linearly with size it exponentially increases with size. There are tremendous future benefits to be gained from allowing individuals to grow to or past reproductive size because of the greater contribution to future fish.

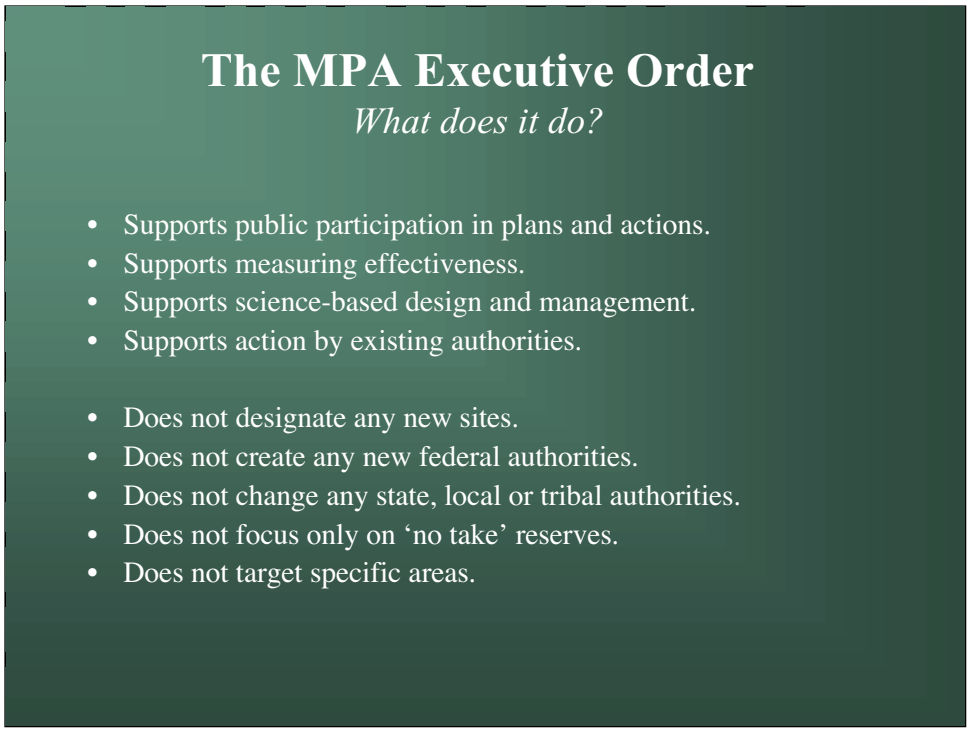


The main question, though, is "How can protection of a part of the ocean habitat provide benefits to the wider ocean ecosystem?" As individuals begin to grow and accumulate within an area protected from extractive activities, the density of individuals increases, to a stage that due to overcrowding individuals are found to migrate or 'spill over' into surrounding areas. These 'spill over' individuals are at risk of being extracted in the non-protected area if fishing pressure outside the reserve is quite intense. But if fishing pressure outside the reserve is moderate in its intensity, a few spill over individuals may remain to grow and reproduce. Not only do large adult individuals migrate to surrounding non-protected areas through mechanisms of colonization, but also eggs and larvae are exported to areas outside the marine reserve. For example, what happens to those 9 million eggs produced by a single 60 cm snapper? Most marine organisms produce pelagic eggs and larvae that disperse and drift away from their natal habitat on prevailing currents. The eggs and larvae grow and mature in the oceanic currents until they reach a stage where they need to settle to suitable bottom habitat to complete their development into a juvenile and adult marine organism. For sessile organisms, the settlement to bottom habitat is permanent, but for most mobile species, such as fish, settlement to an area can be followed by further movement and migration. In summary, protection of marine organisms in side a no-take marine reserve provides benefits to surrounding areas through adult spill over effects and dispersal of eggs and larvae to non-protected areas.



The growing interest in MPAs as a management tool provides many challenges and opportunities. One major challenge is how to effectively use MPAs to reach their goals.

We currently do not possess a comprehensive inventory of existing MPAs within US waters, nor do we have a strategy for building a national network from the collection of individual MPAs. We first need to determine what we have and how the system is functioning with the existing MPAs before we can conduct meaningful assessments and implement improved management schemes.



The MPA Executive Order in general does the following:

•supports public participation in plans and actions;

•supports measuring effectiveness of MPA through science based monitoring schemes and evaluations;

•supports science-based design and management;

•supports actions by existing agencies that have jurisdiction over MPAs;

The MPA Executive Order

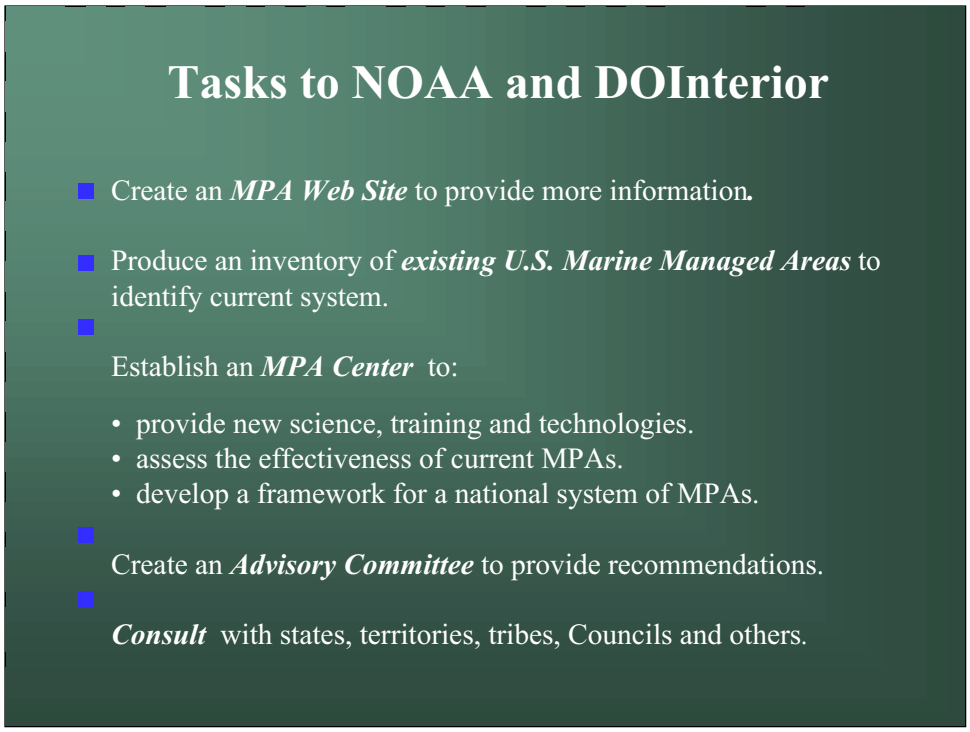
•does not designate any new sites;

•does not create any new federal authorities;

•does not change state, local, or tribal authorities;

•does not focus only on 'no-take' marine reserves;

•does not target specific sites.



Now that we in general know what the Executive Order does and does not support, this presentation would also like to summarize a few specific actions tasked to NOAA and the Department of Interior, which in partnership are tasked with coordinating the following activities:

- create an MPA web site to provide more information on MPAs to the public;
- produce an inventory of existing U.S Marine Managed Areas to identify the current system;
- establish an MPA Center to:
- provide new science, training, and technologies;
- assess the effectiveness of the current system of Marine Managed Areas;
- develop a framework for a national system of MPAs;

create an Advisory Committee to provide recommendations; and finally.

- consult with states, territories, tribes, Councils and others.

Progress Report: November 2001

- **Launched MPA Web Site:**

MPA.GOV

Target: **Monthly updates.**

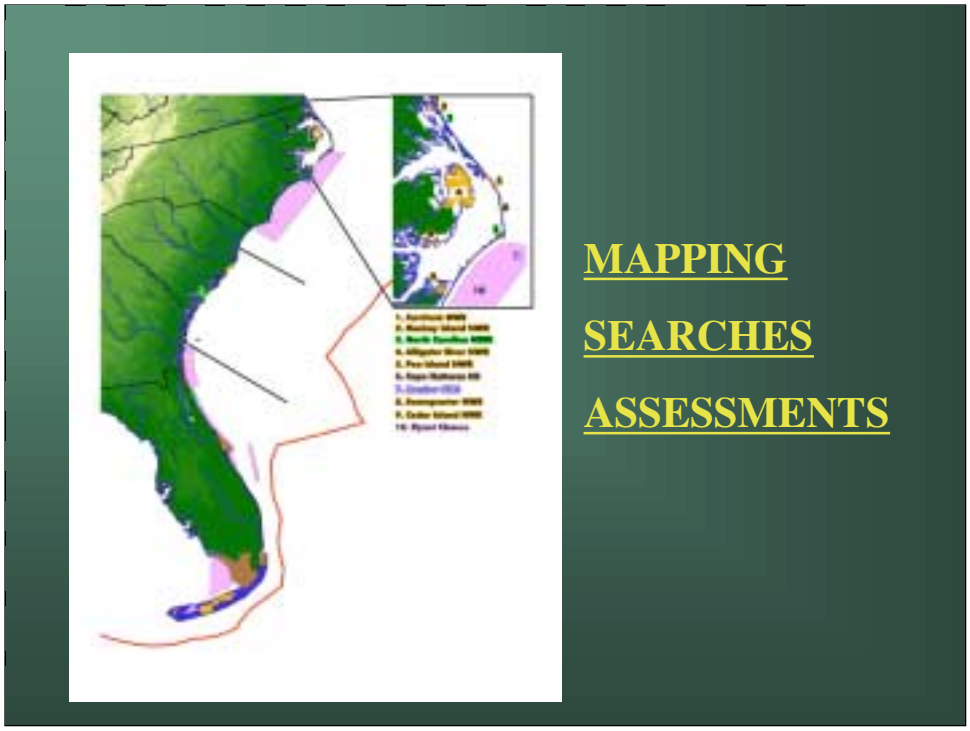
Need: **What is most useful?**

How to make it better?

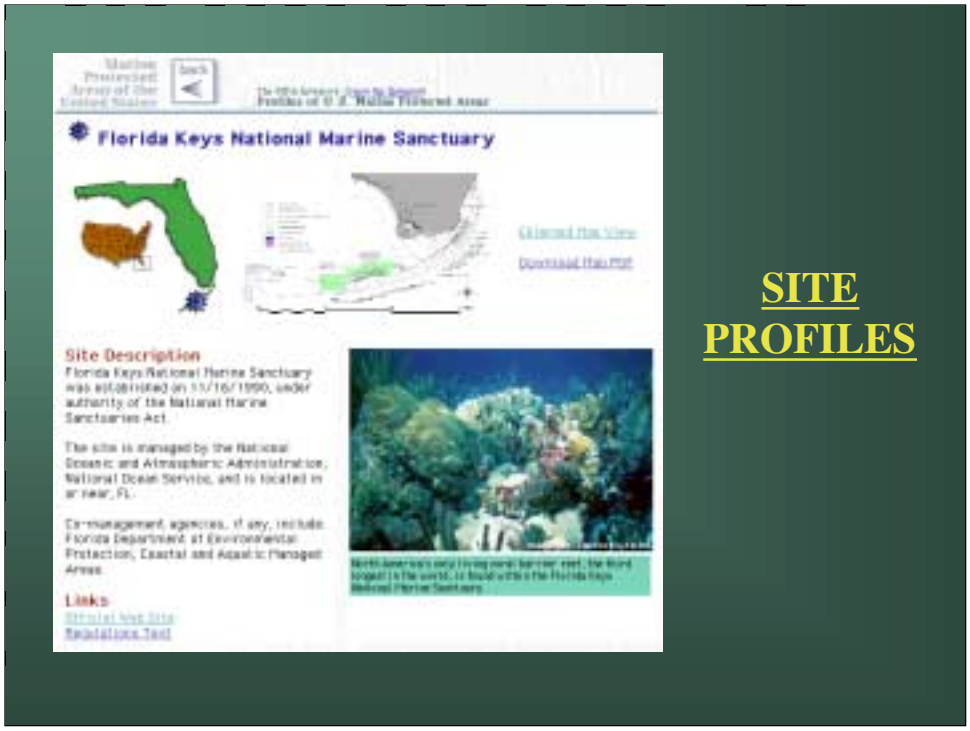
Progress in implementing tasks issued by the Executive Order has been made in following areas:

- The National MPA Center has been established at NOAA Headquarters in Silver Spring with a Science Institute co-located with the Fisheries Science Lab in Santa Cruz, California and a Training and Technical Assistance Institute at the Coastal Services Center in Charleston, South Carolina
- The web site at mpa.gov posts monthly updates of activities accomplished as part of the Executive Order. For example, the inventory of Marine managed areas is posted on the web site, which currently includes information on federally marine managed areas, such as size of area, time of establishment, authorities to establish the site, etc. As part of the inventory, various maps have also been developed and are posted on the web site.

We encourage our stakeholder groups to let us know via the web site how to make the web site and the inventory a better tool.



You can see here one example of a geographical map provided on the mpa.gov web site. The Atlantic coastline is depicted with the federally marine managed sites. Each region can be viewed in more detail by simply clicking on an area of interest. The mpa.gov web provides a visitor the ability to view maps and conduct searches of the inventory of marine managed areas. Eventually visitors will have the ability to conduct comprehensive assessments.



Each site within the marine managed area inventory has a site profile containing general information, such as name and brief description of the site, boundary information, location, legal basis for establishment of the site and its regulation, management information, and finally the information on the types of protections and regulations afforded various resources.

The success and benefits of an MPA depend on full stakeholder participation at all stages of evaluation and implementation of the MPA. Stakeholders range across many diverse groups including fishers, resource agencies, conservationists, recreational marine users, and other countries, to mention just a few.

There are currently many studies that provide evidence for the benefits of MPAs as a marine resource management tool. These studies report increases in the number of individuals inside a no-take marine reserve, as well as increases in the size of individuals and increases in biodiversity. But do these benefits translate into benefits outside the no-take marine reserve? There are but a few studies providing evidence of benefits inside the reserve 'spilling over' into the surrounding non-protected area. A major challenge for MPA design and implementation, besides engaging full stakeholder group participation, is incorporating the practices and dedicating the funds to monitoring effectiveness of an MPA to determine if the MPA is reaching its targets and goals established at time of implementation.